Palaeontological Impact Assessment for the proposed Richards Bay Nseleni Independent Floating Power Plant, KwaZulu Natal Province

Desktop Study (Phase 1)

For

Heritage Contracts and Archaeological Consulting

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 23 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Heritage Contracts and Archaeological Consulting, Modimolle, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision-making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the construction of the Nseleni Independent Floating Power Plant (NIFPP) in the Port of Richards Bay. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

The proposed site lies on the Holocene aged sand dunes of the Sibayi Formation, Maputaland Group, that form a coastal barrier dune cordon that has been flattened by the river flowing into the Port. These sands are very young and have been transported by wind and water action so would not contain any fossils, only sand-sized fragments that are unrecognisable and indistinguishable from modern fragments. There would be no impact on the fossil heritage so as far as the palaeontology is concerned the project can proceed.

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1. Background

HCAC was requested by SE Solutions to submit a Notice of Intent to Develop (NID) to AMAFA as part of the environmental authorization process for the proposed Nseleni Independent Floating Power Plant (NIFPP). The NIFPP falls within the Port of Richards Bay (Remainder Farm 16230: N0GV00000001623000000; Portion 1 of Farm 6230: N0GV00000001623000001; and Portion 45 of Erf 5333: N0GV04210000533300045), while the associated land-based infrastructure will be located on Remainder Erf 5333 (N0GV04210000533300000), within the uMhlathuze Local Municipality and King Cetshwayo District Municipality (Figure 1, 2).

Figure 1. Map Of The Proposed Nseleni Independent Floating Power Plant In The Port Of Richards Bay, Shown In The Yellow Outline. Map Supplied By HCAC.

Figure 2. Google Earth Map of the proposed development of the Richards Bay NIFFP with the sections shown within yellow red outline. Map supplied by HCAC.

Project Details

The NIFPP will make use of Combined Cycle Gas Turbine (CCGT) technology fuelled by Liquid Natural Gas (LNG). The project would be made up of a series of individual floating power plants each of which would be capable of generating 1 350 MW. It is proposed to phase the project, gradually bringing in the power plants to create a combined generation capacity of 5 400 MW. Subsequent phases may take the combined power generation to 16 200 MW.

A substation and transmission switching yard is proposed to be located at the NIFPP CCGT Power Station Facility (located on the Power Barge Terminal/ Quay) housing the step-up transformer, circuit breaker arrangements, protection and control equipment (i.e. voltage and current transformers, relays and SCADA systems). The new on-land transmission substation (proposed to be located to the north-west of the Bayside site) would also feature voltage control/ power factor correction devices such as capacitors, reactors or static volt-ampere reactive compensators and equipment, such as phase shifting transformers to control power flow between the two adjoining power systems, as may be required, to convert the power generated at Medium Voltage (MV) at 22 kV for transmission to High Voltage (HV) at 440 kV/ 765 kV.

To comply with the requirements of South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is presented herein.

Table 1. Specialist report requirements in terms of Appendix 6 of the EIA regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix A
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	none
l	Any conditions for inclusion in the environmental authorisation	none
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	none
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA. The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and,
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

The project lies partly on land and mostly within the Port. The land section includes the substation and infrastructure to the south and west of the existing Bayside Aluminium smelter site.

The geology of the coast of northern KwaZulu-Natal comprises mostly young sediments of the Cenozoic age with littoral marine, estuarine, fluvial and Aeolian origin (Roberts et al., 2006). The deposits are relatively thin onshore but are more substantial offshore, as has been shown by coring and bathymetry (Porat and Botha, 2008; Green, 2009). The Maputaland Group sediments extend from north of Durban to the Mozambique coastal plain. Based on the geological mapping done by Botha (1997) and Maud and Botha (2000) and reported in Roberts at al. (2006), the basal Uloa Formation is mid Miocene in age and the group is topped by the Sibayi Formation. The 1:250 000 geological map (Figure 3) is based on this data and shows that the land around the Richards Bay Port is yellowish redistributed sand of Quaternary age (Qs).

More recent work by Botha and Porat (2007), Porat and Botha (2008) and Botha (2018) has revised the stratigraphy of the Maputaland Group and his system will be used here (Figure 4).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 5. It lies on the Sibayi Formation, <10Ma four parabolic dune units forming transgressive ridges of a coastal barrier dune cordon. The Mseleni core is dated at 1.5ka and is composed of graded sands (Porat and Botha, 2008, fig 8; reproduced here as Figure 4). The site is on the coastal marshlands where the Mhlatuze River has broken through the dune cordon and flows into the estuary that is now the Port of Richards Bay (Figures 1, 4).

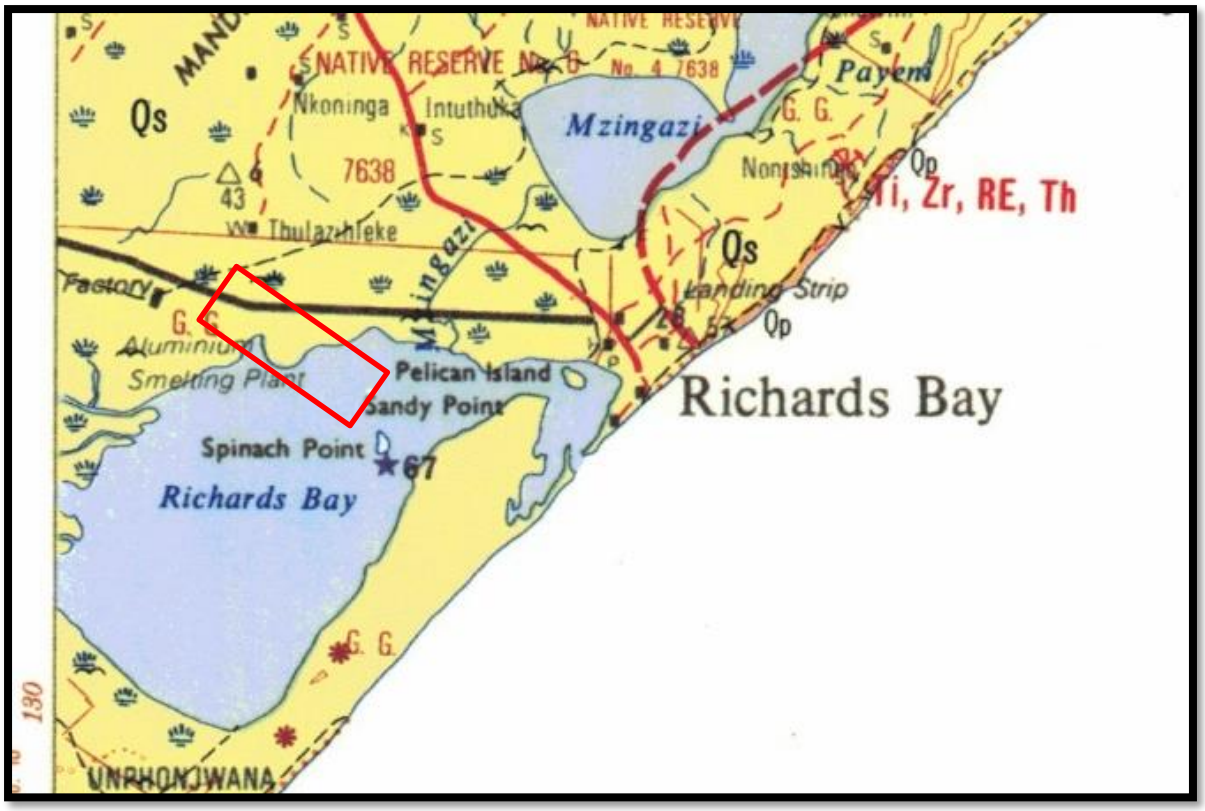

Figure 3. Historical* geological map of the area around the Port of Richards Bay with the project shown within the red rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the geological survey 1: 250 000 map 2732 St Lucia.

Table 2. Explanation of symbols for the geological map and approximate ages (Botha 2018; Porat and Botha, 2008; Roberts Et Al., 2006). SG = Supergroup; Fm = Formation; Ma = Million Years; Grey Shading = Formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary Sibayi Fm, Maputaland Group	Yellowish redistributed sand	Holocene, 11 – 2.3 Ma
Qp	Port Durnford Fm, Maputaland Group	Mudstone, sand, shale, lignite	Late Middle Pleistocene
Qb	Bluff Fm = Umkwelane Fm, Maputaland Group	Calcareous sandstone, limestone	Middle Miocene

**Note that this is the only available geological map and subsequent surface developments are not indicated on historical maps.*

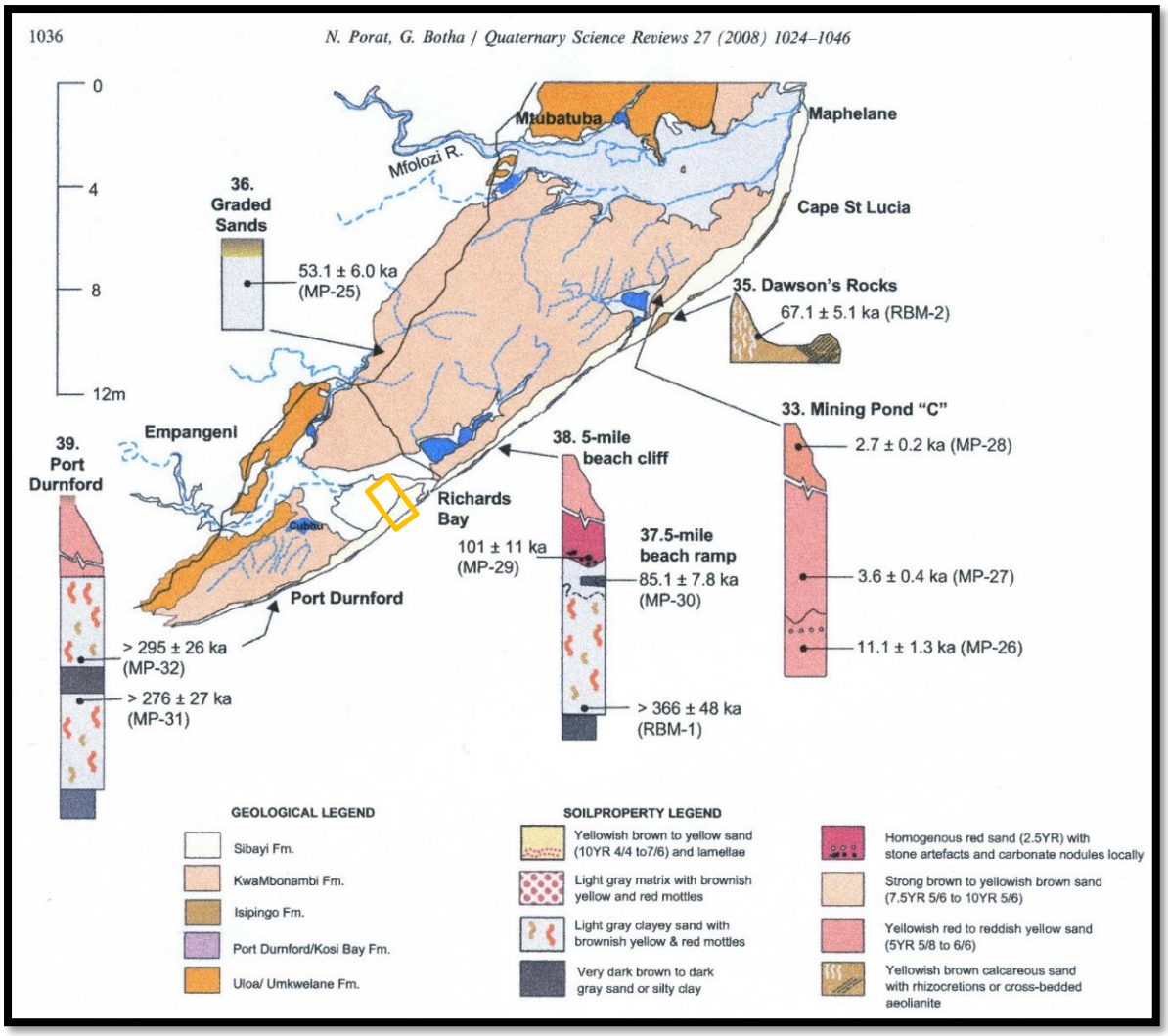

Figure 4. Updated stratigraphy of the area around Richards Bay (figure 8 of Porat and Botha, 2008), with the project site within the yellow rectangle. According to this map the landward section of the project site is in the Sibayi formation (white).

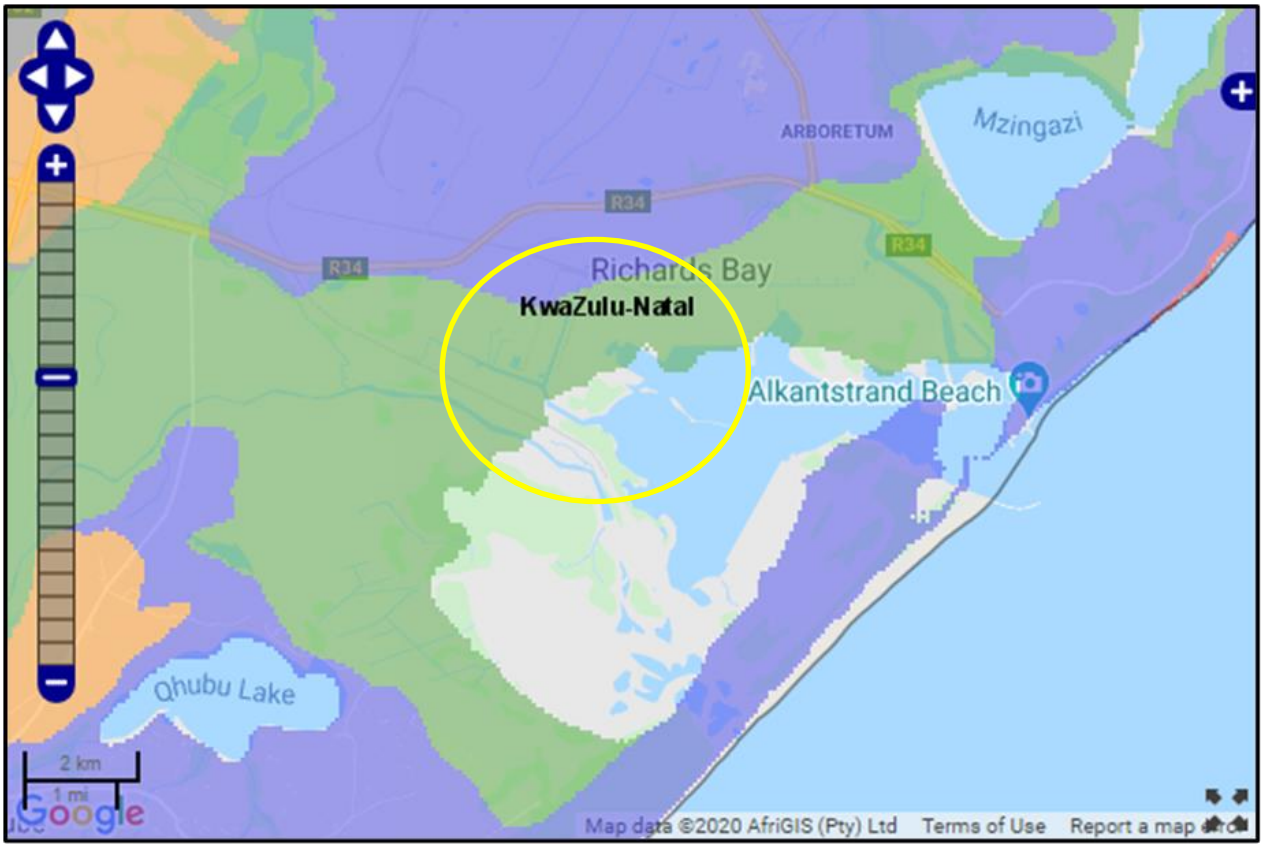

Figure 5. SAHRIS palaeosensitivity map for the site for the proposed NIFPP shown within the yellow polygon. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

Based on the SAHRIS map above the study area falls in an area of moderate paleontological sensitivity and therefor a desktop study has been completed. Since the Sibayi Formation sand dunes, like most coastal sand dunes, are composed of windblown (Aeolian) sands, they are not in primary context. Fragmentary fossil shells of Holocene age might be incorporated into the sands but they would be young and very difficult to distinguish from subfossil or modern marine shell fragments.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in

:

TABLE 3 A and B – Impact Assessment

Table 3A: Criteria for Assessing Impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 3B: Impact Assessment

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Aeolian sands do not preserve marine, vertebrate or plant fossils; so far there are no records from the Sibaya Formation of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since only the possible fossils within the area would be fragmentary marine shells in the sand dunes, the spatial scale will be localised within the site boundary.
	M	-

PART B: ASSESSMENT		
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the aeolian sands of the Sibayi Fm, and they would be indistinguishable from modern shells. There would be no impact on the fossil heritage.

Based on the nature of the project, on-land activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too young, and have been transported by wind and wave action, to contain fossils. Furthermore, the site is coastal marshland that has been highly disturbed by previous activities, so would not preserve any recognisable fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sand dunes are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The transported sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Holocene aged Sibayi Formation sands. The sands are wind and water transported so the particles have been very well sorted and, even if fossils fragments have been incorporated into the sands, they would not be recognisable. There is no chance that fossils may occur in the dune sands so as far as the palaeontology is concerned the project can proceed, both onshore and offshore in the Port of Richards Bay.

7. References

Botha, G.A., 2018. Lithostratigraphy of the late Cenozoic Maputaland Group. South African Journal of Geology 121, 95-108.

Porat, N., Botha, G.A., 2008. The chronology of dune development on the Maputaland coastal plain, southeast Africa. Quaternary Science Reviews, 27, 1024-1046.

Botha, G.A., 1997. The Maputaland Group: a provisional lithostratigraphy for coastal KwaZulu Natal. In: Botha, G.A. (Ed). Maputaland. Focus on the Quaternary Evolution of the Southeast African Coastal Plain. Field guide and abstracts. INQUA/Council for Geoscience, Pretoria, 21-26.

Green, A.N., 2009. Palaeo-drainage, incised valley fills and transgressive systems tract sedimentation of the northern KwaZulu-Natal continental shelf, South Africa, SW Indian Ocean. Marine Geology 263, 46-63.

Maud, R.R. and Botha, G.A., 2000. Deposits of the southeastern and southern coasts In: Partridge, T.C., Maud, R.R., (Eds). The Cenozoic of Southern Africa. Oxford University Press, New York, 19-32.

Porat, N. and Botha, G.A., 2008. The chronology of dune development on the Maputaland coastal plain, southeast Africa. Quaternary Science Reviews 27, 1024-1046.

Roberts, D.L., Botha, G.A., Maud, R.R., Pether, J., 2006. Coastal Cenozoic deposits. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 605-628.

Appendix A – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
April 2020

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	9	2
Masters	9	5
PhD	11	5
Postdoctoral fellows	10	4

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 –
Journal of African Earth Sciences: 2020 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision

- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
-

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h-index = 27; Google scholar h-index = 32; -i10-index = 80
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)